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PARTIAL D[illegible] WD - Family

OPERATION CASTLE

[illegible]Y PRELIMINARY REPORT OF THE RESULTS [redacted] 410656

DELETED VERSION ONLY

Submitted by

Task Group 7.1

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JO-10

20 May 1954
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TABLE OF CONTENTS

Program & Project		Page
INTRODUCTION		9
PART I - TU13 - DOD PROGRAMS		10
1	BLAST AND SHOCK MEASUREMENTS	
1.1a	Blast Pressures by Rocket Trail Photography	11
1.1b	Blast Phenomena by Surface Photography.	11
1.1c	Base Surge Measurements by Photography	12
1.1d	Peak Pressure by Aerial Photography	13
1.2a	Pressure vs Time (Moderate Pressures)	14
1.2b	Pressure vs Time (High Pressures).	15
1.3	Shock Winds and Afterwinds	18
1.4	Underwater Pressure vs Time	20
1.6	Water Wave Studies.	33
2	NUCLEAR EFFECTS	
2.7	Survey of Radiological Fall-out by Oceanographic Methods.	35
6	TEST OF SERVICE EQUIPMENT AND OPERATION	
6.1	Test of Interim IBDA Procedures for High Yield Weapons. .	40
6.2a	Blast, Gust and Thermal Effects on a Manned B-36.	42
6.2b	Thermal Effects on B-47B Aircraft.	43
6.4	Proof Testing on AW Ship Countermeasures	44
6.6	Ionosphere Studies.	53
7	LONG RANGE DETECTION	
7.1	Electromagnetic Radiation Calibration.	57
7.2	Detection of Airborne Low Frequency Sound from Nuclear. . Explosions	62
7.4	Calibration Analysis of A-Bomb Debris.	64

[redacted]

[redacted]

Program & Project		Page
9	SUPPORTING MEASUREMENTS	
9.1	Cloud Photography	66
PART II - TU-1 - LASL PROGRAMS AND ASSOCIATED DIAGNOSTIC EXPERIMENTS		67
J-10	LASL ANALYSIS	68
11	RADIOCHEMISTRY	
11.1	Analysis for Fission and Fusion Energy Yields	70
11.2	Cloud Sampling	71
13	PHOTOGRAPHY	
13.1	Ball of Fire Photography	73
13.2	Cloud Photography	74
13.3	Bhangmeters	75
13.4	High Speed Photography	76
13.5	Time Interval Measurement	76
14	EXTERNAL NEUTRON MEASUREMENTS	
14.1	Threshold Detectors	80
15	ALPHA MEASUREMENTS	
15.1	Teller and Scintillation Alpha	81
15.2	Electromagnetic Experiment	82
17	MICROBAROGRAPHY	
17.1	Microbarographic Measurements	83
18	THERMAL RADIATION	
18.1	Time Interval Measurements	85
18.2	Power as a Function of Time	87
18.3	Spectroscopy	89
18.4	Atmospheric Transmission	92
18.5	Total Thermal Radiation	94

[redacted]

[redacted]

Program & Project	Page
PART III - TU-7	96
TU-7 Radiological Safety	97
PART IV - TU-15 AND GENERAL INFORMATION	99
TU-15 Timing and Firing	100
GENERAL INFORMATION	
Weather at Bikini Atoll at Shot Time	101
Map of Bikini Atoll	102
Distribution List	103

[redacted]

4

[redacted]

LIST OF TABLES

Program & Project — Page

PART I

1 BLAST AND SHOCK MEASUREMENTS

1.2a-1 Overpressure, [redacted] 14

1.2b-1 Results [redacted]. 16

1.3-1 Results [redacted]. 19

1.4-1 Experimental Set-up 21

1.4-2 Buoy D-3 [redacted] (NOL) 24-25

1.4-3 Buoy A-1 [redacted] (NOL) 26

1.4-4 Ball Crusher Gage Deformations, [redacted] 29

1.4-5 Data from New Wiancko System 30

1.4-6 Results of the DTMB Ball Crusher Gage Readings 30

1.6-1 Results, [redacted]. 33

1.6-2 Results, shots [redacted]. 34

6 TEST OF SERVICE EQUIPMENT AND OPERATION

6.1-1 B-50 Positions 40

7 LONG RANGE DETECTION

7.1-1 Results - Remote Stations. 61

7.2-1 Project 7.2 - Results 63

7.4-1 Project 7.4 - Sample Results. 65

PART II

J-10 LASL ANALYSIS

10-1 Time Difference Results 68

10-2 Diameter-Time 69

11 RADIOCHEMISTRY

11.2-1 Sampling Results [redacted] 72

[redacted]

[redacted]

Program & Project		Page
15 ALPHA MEASUREMENTS	
15.1	Alpha Trace Results.	81
17 MICROBAROGRAPHY	
17.1	Summary of Microbarograph Data	84
18 THERMAL RADIATION	
18.5-1	Enyu Results	94
18.5-2	Scrapiron Barge Results.	94
PART III	
TU-7 RADIOLOGICAL SAFETY	
7-1	[redacted] Radiation Summary.	98
PART IV	
GENERAL INFORMATION	
A-1	Weather (Bikini Atoll) at Shot Time	101

[redacted]

6

[redacted]

LIST OF ILLUSTRATIONS

Program & Project — Page

PART I

1 BLAST AND SHOCK MEASUREMENTS

1.2b-1 Ground Surface Pressure vs Distance 17

1.4-1 Underwater Maximum Pressure-Distance Curve. 27

2 NUCLEAR EFFECTS

2.7-1 Preliminary Over-Water Fall-out Data 39

6 TEST OF SERVICE EQUIPMENT AND OPERATION

6.4-1 Ships' Course 48

6.4-2 Preliminary Estimate of Washdown Effectiveness on Painted Steel Surfaces 49

6.4-3 Representative Dose Rates on Painted Steel Surfaces . . . 50

6.4-4 Representative Cumulative Dose on Painted Steel Surfaces. 51

6.4-5 BAKER Plane - Decontamination History 52

6.6-1 Typical Ionospheric Record 55

6.6-2 Ionospheric Record 1 Hour and 23 minutes After [redacted] . . 55

6.6-3 Ionospheric Record 2 Hours and 5 minutes After [redacted] . . 56

7 LONG RANGE DETECTION

7.1-1 Timing Record, Parry Island Station 59

7.1-2 EM Signal 12.8 µsec/cm Sweep Speed - Runit. 59

7.1-3 EM Signal 32 µsec/cm Sweep Speed - Runit. 60

7.1-4 EM Signal 20 µsec/cm Sweep Speed - Runit. 60

PART II

13 PHOTOGRAPHY

13.5-1 Complete Model 100 Streak Record 78

13.5-2 Model 100 Streak Record 79

[redacted]

[redacted]

Program & Project — Page

18 THERMAL RADIATION

18.1-1 Trace from Enyu. Most Sensitive Differentiated Detector . 86

18.2-1 Power as a Function of Time. 88

18.4-1 Atmospheric Transmission from Sta. 40 to Bikini Is. . . . 93

18.4-2 Atmospheric Transmission from Sta. 40 to Enyu 93

PART IV

GENERAL INFORMATION

A-1 Map of Bikini Atoll 102

8

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INTRODUCTION

The first [redacted] shot, fired March 27, 1954, gave a satisfactory yield (~11 MT) from the point of view of the designers, the Los Alamos Scientific Laboratory. However, the device was still more expensive to produce than might be necessary

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the LASL constructed a device [redacted] which was essentially the same as the first

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This device was flown to Eniwetok and fired on 5 May 1954 as a barge shot [redacted] (just south of Yurochi). [redacted] giving an energy release of 13.5±1 megatons,

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The following project reports are in general preliminary. Later and better information will be available in the final reports of the separate projects.

[redacted]

[redacted]

PART I

TASK UNIT 13

DOD PROGRAMS

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10

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Project 2.7 - SURVEY OF RADIOLOGICAL FALL-OUT BY OCEANOGRAPHIC METHODS

(T.R. Folsom, F.D. Jennings, J.D. Isaacs, R. Revelle)

(Scripps Institution of Oceanography)

Objectives

To determine the distribution of the major fall-out downwind by oceanographic methods.

To measure depth and rate of diffusion of fall-out required for an estimate of the integral activity over the area.

To collect otherwise unattainable specimens, technical data, and field experience essential for the success of future operational planning and instrumentation.

General Character of the Survey

The ATF-75 (Sioux) was hurriedly fitted with hydrographic gear and with improvised radiation detectors capable of being towed and lowered vertically into the sea. Between Y + 6 hours and Y + 4 days an 800 mile long traverse of the suspected downwind area was made, sections being made near radii 30, 50, 100, 150, and 200 miles. Hydrographic casts were made at stations evidencing distinctly active water; water samples were taken to depths as great as 2400 feet. Surface water was collected frequently along the traverse while the ship was in motion.

Between stations, radiation indicators were towed astern so that the surface water activity could be continuously monitored.

At three stations a special geiger counter device was lowered to the end of a 300 ft cable and its reading was recorded as a function of depth. In two instances, it passed through the contamination and into the clear water below giving the extent of diffusion directly. Water samples, of course, will provide further information of this type.

Bathythermographs were taken at fixed stations, no gear was available for underway measurements. These measurements, of great value in establishing the state of mix of the upper layers, were greatly augmented by BT's sent in from DDE which had been steaming in nearby areas.

A very interesting demonstration of the radioactivity concentrating ability of marine life was made. Two plankton casts were made in water of measured activity and the organisms were found to be many times more active than their medium.

Navigation during the later phases was largely determined by the outcome of the intensity monitoring. The length of the trip was not limited by the ability of even this improvised gear to detect radioactivity but rather by the ability of a single slow-moving ship to traverse significant water surfaces before these broke up into eddys and moved out of reach.

The ship returned on schedule, all gear intact.

Measurements Made

The planned equipment, procedure, and personnel are itemized in the original plan DELETED [redacted] completed by Revelle, Isaacs and Folsom and circulated on 27 April by Task Unit 13.

Actual measurements [redacted] were modified slightly to fit field circumstances which then existed.

Hydrographic Stations

Eight positions (see Fig. 2.7-1).

One cast to 0, 50, 100, 150, 200, 500, 800 meters.

Four casts to 0, 25, 50, 100, 200, 500 meters.

Four casts to 0, 25, 50, 100, 175 meters.

Dual protected thermometers at all depths. (No unprotected thermometers available).

Nansen bottles, 4 to 6 each cast.

Specially improvised plastic bottles, 4 in every cast.

Bathythermograph at 12 positions.

Plankton net cast, samples collected at two stations at 2 knots and depths to about 500 feet.

Vertical profile measurements of intensity to 240 feet at 3 stations.

Inter-station Measurements

Eight hundred miles of continuous monitoring of surface layer intensity.

A few intercomparisons were made at deck-level and bridge-level with Rad-Safe units.

Extra surface water samples were taken at 15 points on the course without stopping.

Preliminary Results

Fig. 2.7-1 shows:

Unprocessed field measurements of radiation intensity due to fall-out from Runt 2,

Positions of hydrographic stations where deep water samples were collected, and

Positions where vertical profiles of intensity were measured directly.

The broken line represents the intensity of filtered radiation, giving relative intensity in terms of distance from the solid course line as a base.

No correction has been applied for attenuation due to age, character of fall-out, nor for diffusion of surface water, and final instrumental calibrations have not been utilized.

13

[redacted]

Conclusions

It is feasible to use oceanographic techniques for surveying fall-out. The special devices improvised here should be added to and perfected.

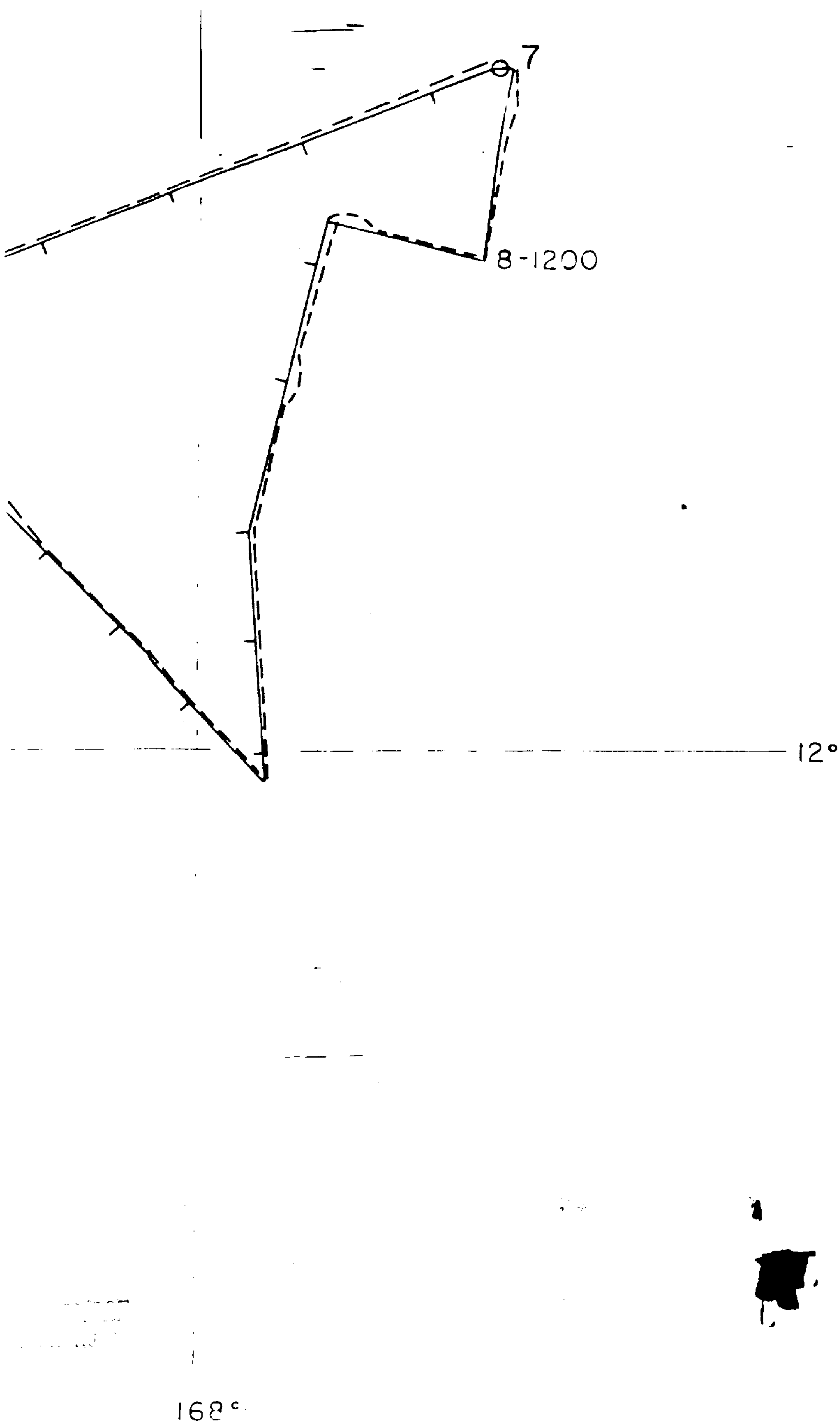
The [redacted] fall-out has been fairly well documented.

It is now established that the fall-out contaminated the sea uniformly to about 200 feet in depth after one day, to about 400 feet in depth by the second day. Oceanographic experience and theory indicates that further penetration will be extremely slow.

Future surveys of this type should be supplemented by a much simpler synoptic survey made by fast moving ships or by ships and aircraft.

Because of these findings, it is to be urged that the development of techniques for detecting and identifying contaminated sea areas by aircraft be fully supported and that these experiments be tied-in with surveys by surface vessels and with oceanographic studies.

[redacted]



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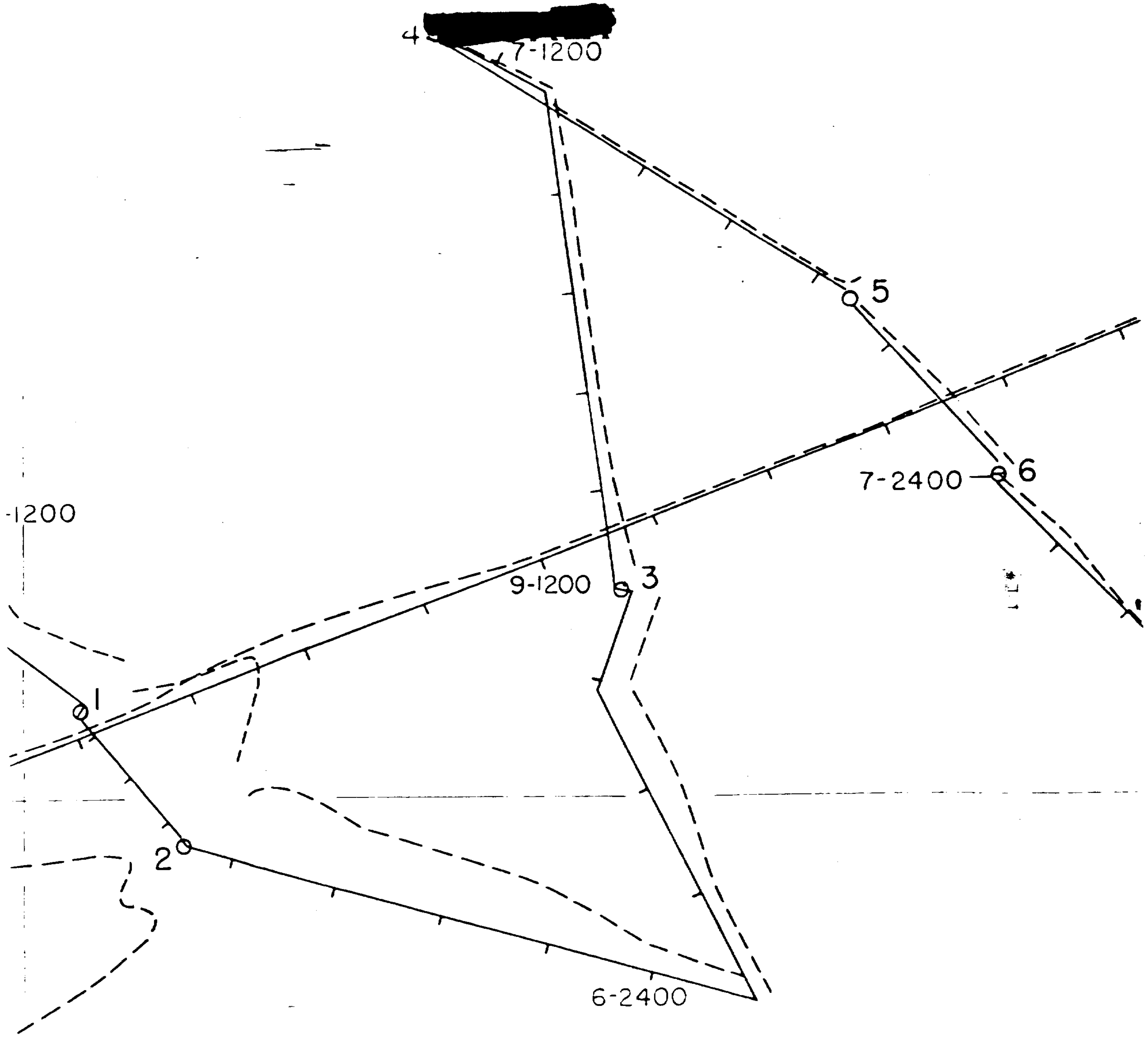

PRELIMINARY OVER-WATER FALL-OUT DATA---
RELATIVE INTENSITY GIVEN BY DISTANCE FROM
SOLID COURSE LINE TO DOTTED LINE

FIG. 2.7-1 [redacted]

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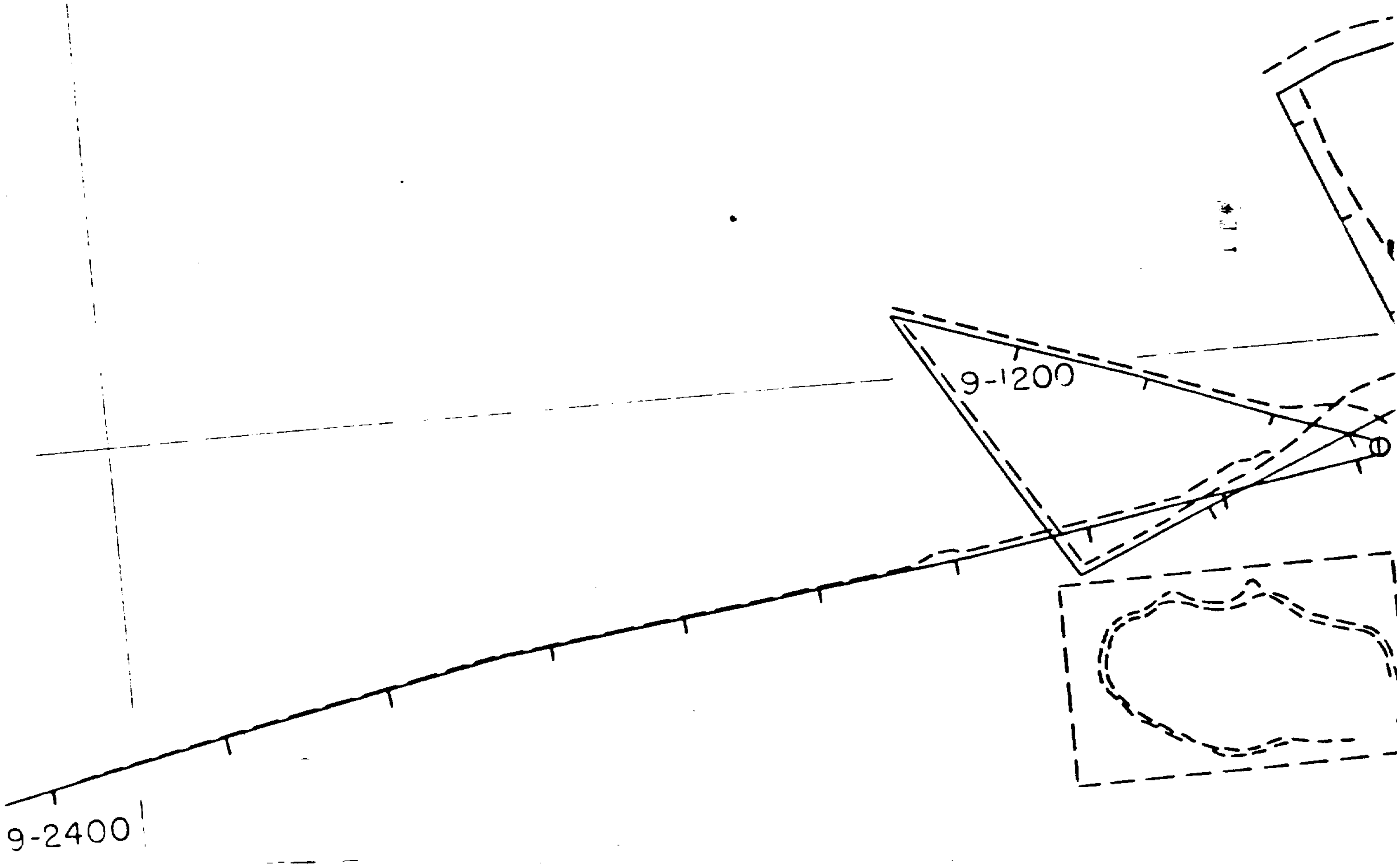
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Project 6.4 - PROOF TESTING ON AW SHIP COUNTERMEASURES

Project Officer - G. G. Molumphy, CAPT, USN

General

As in the previous test, YAG 39 was manned by a special primary control party receiving course instructions from a secondary control party aboard USS Bairoko. Operations for this shot were completely successful. Spacing between the vessels varied somewhat more than during the previous test, but was generally within 3,000 yards. Ships' courses are shown in Fig. 6.4-1. Peak dose rates on YAG 40 were within the desired range. After recovery, the ships were returned to Parry where survey, and recovery of aircraft, samples, and recorded data were accomplished.

Gamma Instrumentation

Continuous gamma radiation measurements were recorded for the same stations as in previous tests. All 137 stations with 427 detectors were in operation. Of these, approximately 50 detectors were of questionable performance. There were no detector failures noted during the first 100 hours.

Washdown

This test should yield fair values of washdown effectiveness even though the two ships seem to have received different amounts of fallout. The masthead stations received similar treatment, i.e., no dome wash was used on either ship, and it is estimated from their data that YAG 39 received about 1.6 times as much contamination as YAG 40. The factor 1.6 is utilized in the estimation of washdown effectiveness.

A shipwide average of washdown effectiveness on similar surfaces as a function of time is presented in Fig. 6.4-2.

[redacted]

18

Fig. 6.4-3 and Fig. 6.4-4 show some representative dose rate and cumulative dose values respectively. Data on the cumulative dose rate has not yet been reduced beyond that time shown since evaluation of washdown is most important during the period H + 12 hours.

The reversal in relative magnitudes of dose rate fore and aft on the two ships again seems to be present. Possible differences in washdown effectiveness on different areas of the ships may be indicated.

Shielding Studies

Adequate data were obtained from this test but the calculations and evaluation of results will be done at USNRDL because of lack of personnel and time at the test site.

Radiological Survey and Photography

A complete initial survey was performed on YAG 39. Because of high dose rates only 75% of the weather surface survey points were covered on YAG 40, although the interior survey was complete. Survey support was supplied for both ship and aircraft decontamination. Surveys included gamma field, surface beta, directional gamma measurements, and wipe samples.

The camera station operated successfully but preliminary examination of the film showed no evidence of gross fallout.

Ship Decontamination

No experimental decontamination was performed. Operational methods of decontamination were used to bring the radiation levels on the ships down to values which will allow for a return to home port without subjecting the ships' personnel to excessive radiation dosage.

YAG 39 was decontaminated first and was then used as a base of operation for the decontamination of YAG 40. The average level on YAG 39 was reduced to 43 mr/hr at 7.5 days after shot. It is estimated that this value will allow a 30 day trip without exceeding 3.9 r dosage for the crew.

The departure of certain Task Force ships delayed the decontamination of YAG 40 because the trained decontamination personnel left with them. As soon as other personnel are obtained and trained, decontamination will proceed. This decontamination will consist, in part, of the removal of special protective coatings from all topside surfaces. It is estimated that this operation will require 525 man-hours.

Aircraft Studies

The aircraft were off-loaded after they had been on the YAGs less than a week. On the Able (YAG 39) aircraft the left magneto drop-off was above tolerance but not excessive. No other damage except minor corrosion was evident. Since the Baker (YAG 40) aircraft did not check out before the shot no inspection was made afterward.

On the Able aircraft, decontamination was accomplished by use of hot liquid jet with detergent, scrubbing with detergent, and scrubbing with Gunk, all in sequence. This treatment reduced the cockpit reading from 220 mr/hr to 52 mr/hr.

Fig. 6.4-5 shows the decontamination methods and results on the Baker aircraft.

Taking into account the difference in contamination levels on the two ships (see Washdown) it is estimated that the washdown was 95% effective at 7 hours after shot.

The contaminant was not visible on either aircraft. Beta radiation levels on top surfaces were 2 to 5 times those on underside surfaces. Vertical

21

surfaces showed a wide variation but no pattern seemed evident. The engine was contaminated to a greater extent than previously. The carbonized exhaust trails were especially active, as were other rough absorbent surfaces such as the walkways.

Interior Contamination

The time of instrument operation was set for 24 hours to allow sampling up to H+20 hours. Three air samplers in the fireroom of YAG 40 and one air sampler in the fireroom of YAG 39 were not set up to operate because of lack of time between shots. For the same reason surface samplers were not affixed to the walls of the boiler fidley spaces.

Heavy rains which fell about 36 hours after shot time completely destroyed all topside millipore filters. However, millipore filters recovered from below deck spaces and air sampler filter reels showed considerably more activity than was observed on samples from previous shots.

All samples have been sent to USNRDL for analysis.

Personnel Protection and Radiological Safety

The usual support and services were supplied during recovery of the YAGs, recovery of the aircraft and samples, and during aircraft and ship decontamination

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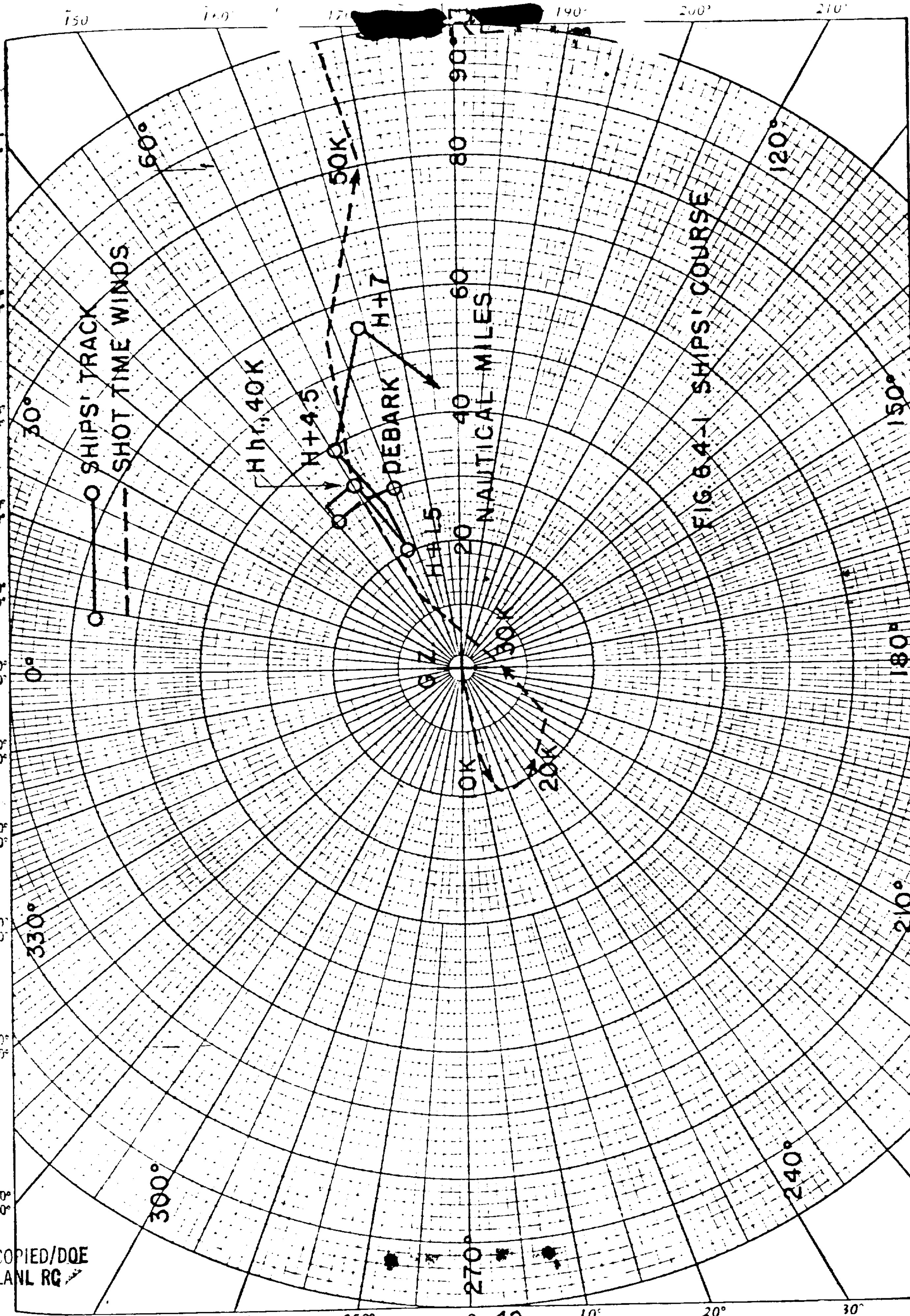

FIG. 6.4-1 SHIPS' COURSE

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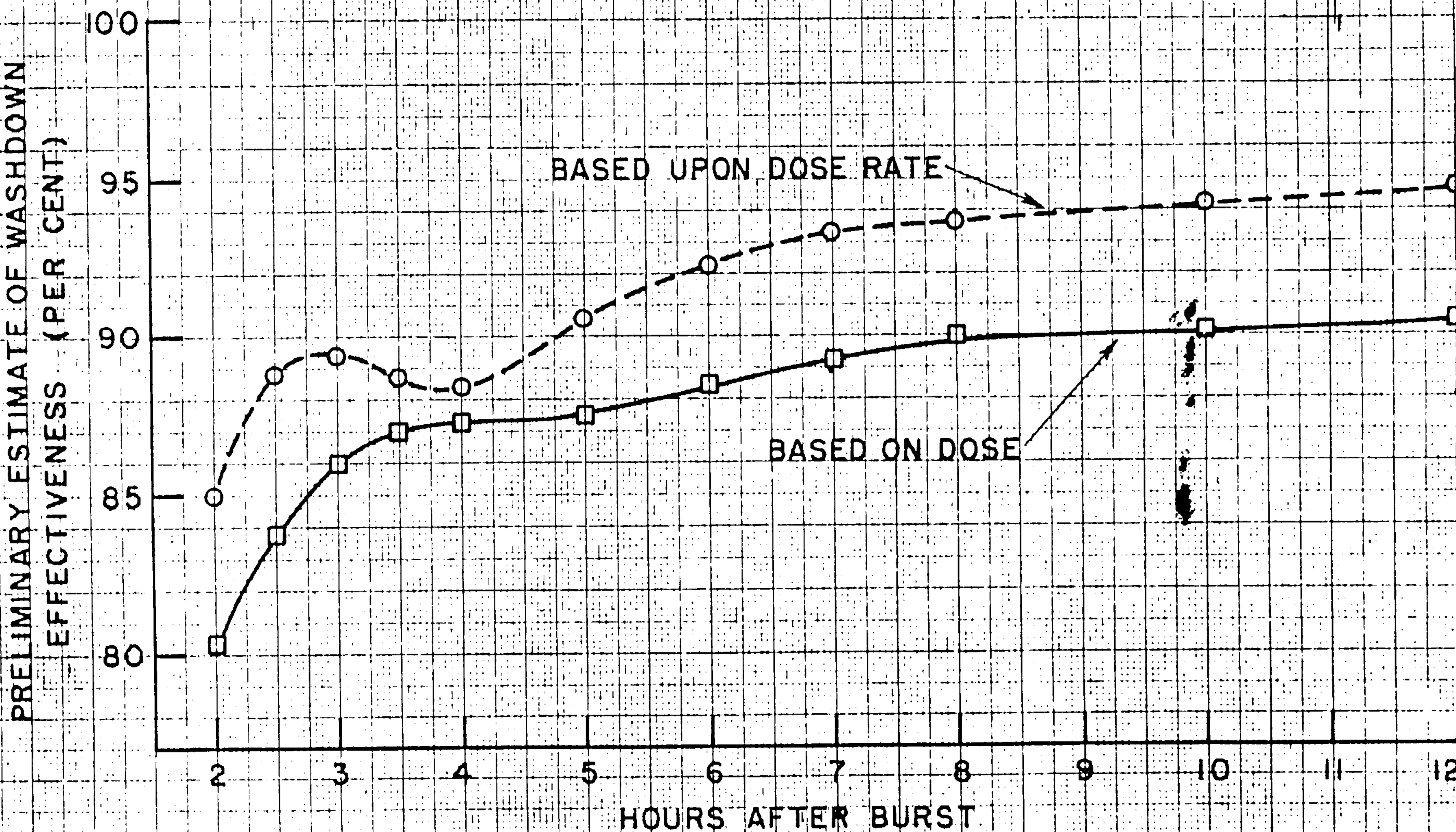

FIG. 6.4-2 PRELIMINARY ESTIMATE OF WASHDOWN EFFECTIVENESS ON PAINTED STEEL SURFACES. (AVERAGE OF SIX STATIONS – THREE MAIN DECK FWD., THREE MAIN DECK AFT.)

[redacted]

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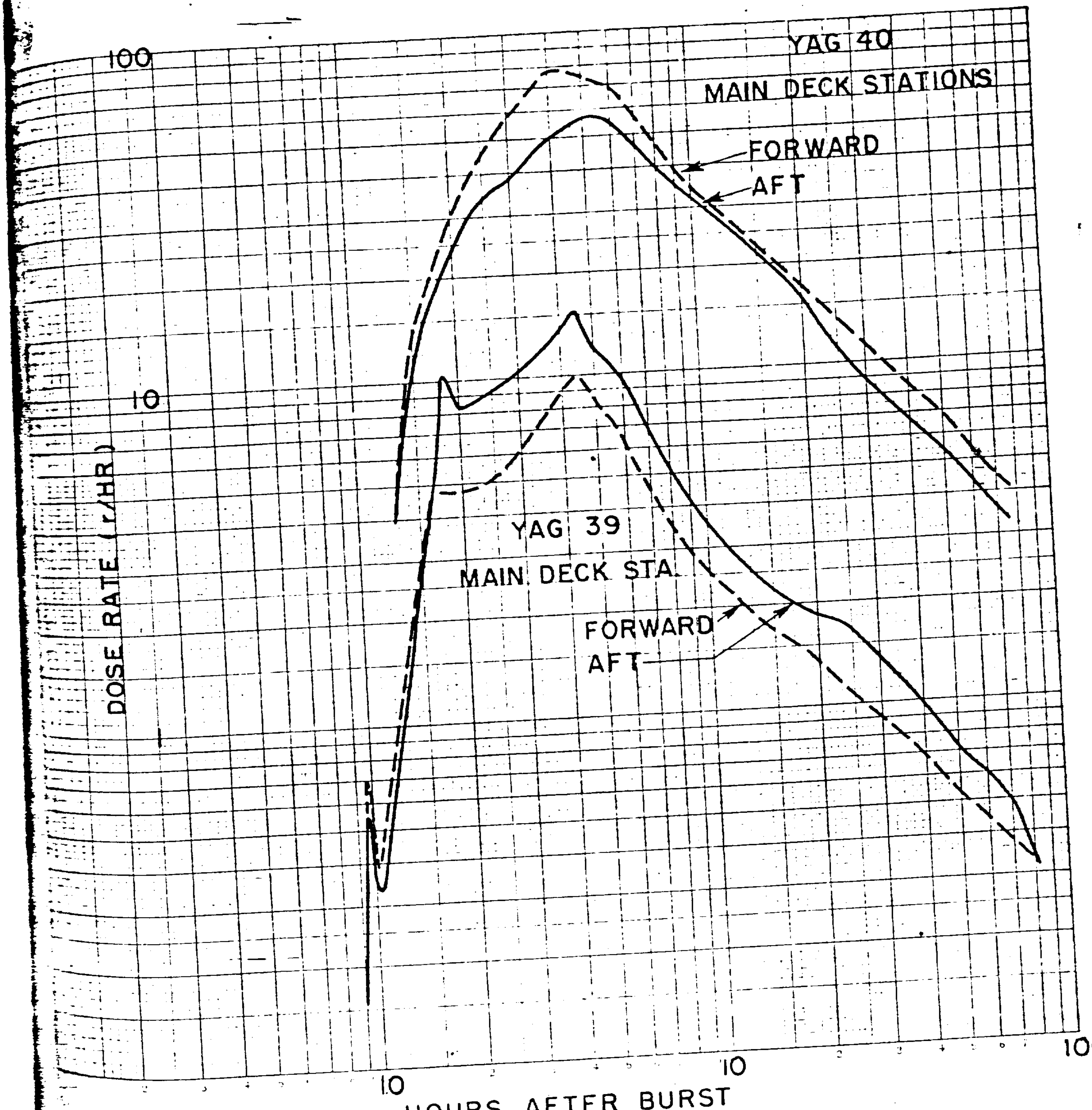

FIG. 6.4-3 REPRESENTATIVE DOSE RATES ON PAINTED STEEL SURFACES

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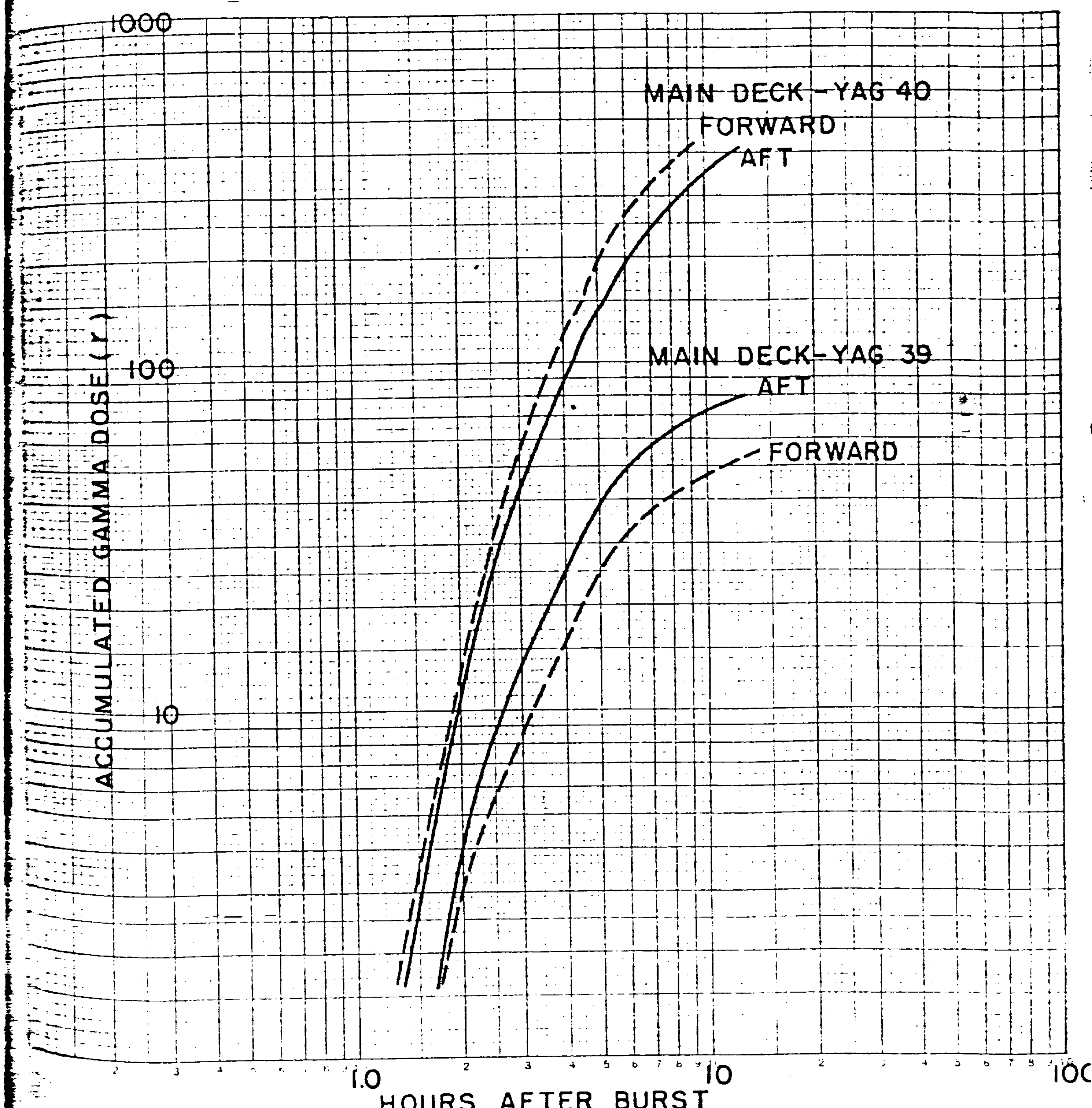

FIG. 6.4-4 REPRESENTATIVE CUMULATIVE DOSE ON PAINTED STEEL SURFACES

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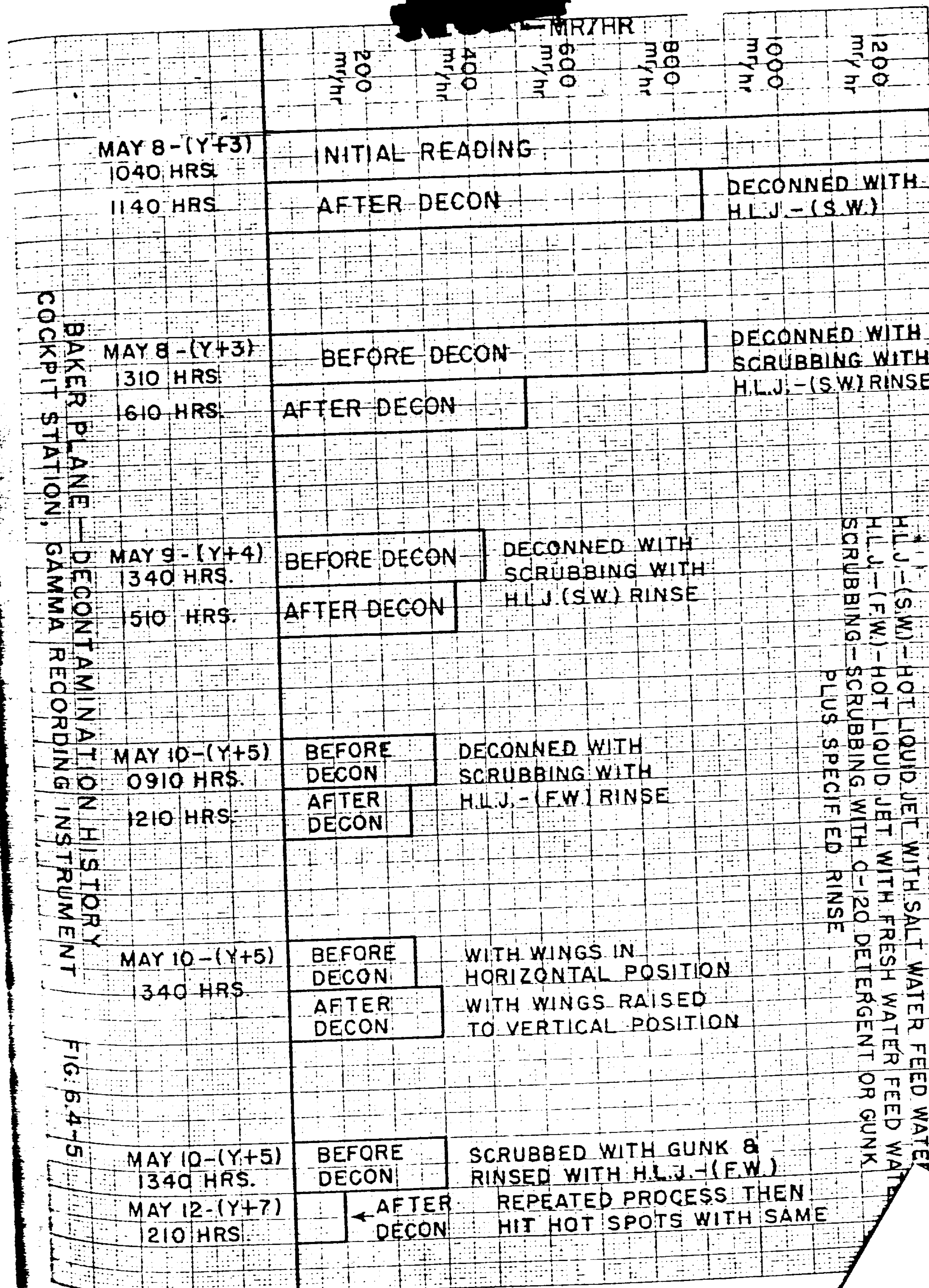

BAKER PLANE — DECONTAMINATION HISTORY
COCKPIT STATION, GAMMA RECORDING INSTRUMENT
FIG. 6.4-5

26

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Project 11.2 - CLOUD SAMPLING

(H. Plank)

Aircraft Sampling

As was done [redacted] approximately a half effort sampling mission was attempted [redacted] in order to meet a requirement of being able to sample [redacted] within a short time [redacted] It was again attempted to collect the same total amount of cloud debris as on a full-scale effort by doubling the in-cloud gamma radiation exposures for the single F-84G aircraft which replaced a pair. As seen in Table 11.2-1, the results of this approach were approximately the same [redacted] Only Red 1 and White 1 were able to increase their collection significantly over normal.

The periodicity of Red 1, White 1, and Blue 1 in having large samples relative to the other F-84G aircraft is a reflection of the arc-like shape assumed by the cloud as a result of wind shear and the masking of the primary cloud material by natural water vapor cloud. The above three aircraft were successively vectored to the same side of the cloud and experienced less gamma radiation shine from cloud layers in which they were not flying than did the others. Because of the shape of the bomb cloud and the associated vapor cloud it was difficult to find a position for the control B-36 which was equally advantageous to all sampling aircraft.

Radiation intensities observed by the sampling aircraft were, in general, lower than those found on other shots at corresponding times after burst. The reason for this appears to be excessive wind shear at all sampling altitudes as well as the difficulty of finding primary cloud to fly within.

Study of the spectral distribution of gamma photons within the cloud was continued but the data have not been analysed.

[redacted]

TABLE 11.2-1

SAMPLING RESULTS [redacted]

Aircraft Code	Type Aircraft and Number	Avg. Sampling Time (Hrs. after Burst)	[redacted] Total Fissions Collected	[redacted] Total Fissions Collected
Red 1	F-84G 037	2:10	2.70×10^{16}	4.94×10^{16}
Red 2	F-84G 032	3:10	0.76×10^{16}	1.20×10^{16}
White 1	F-84G 051	3:20	2.94×10^{16}	Abort
White 2	F-84G 046	3:30	0.09×10^{16}	1.72×10^{16}
Blue 1	F-84G 048	3:35	2.34×10^{16}	1.12×10^{16}
Blue 3	F-84G 042	4:15	1.02×10^{16}	1.90×10^{16}
Blue 4	F-84G 043	4:15	0.85×10^{16}	1.9×10^{16}
Floyd 1	FB-36 1086	4:00	0.48×10^{16}	0.98×10^{16}
Wilson 1	WB-29 7343	3:10	1.05×10^{16}	0.266×10^{16}

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PART III

TASK UNIT 7

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TASK UNIT 7 - J. D. SERVIS, MAJ, USA

(J. D. Servis, Maj, USA)

RADIOLOGICAL SAFETY

A damage and radiation survey was conducted at H+4 hours [redacted] This survey covered the islands of the atoll and was conclusive enough to limit reentry to Enyu and Airukiiji on the first day. This survey indicated that recontamination was extensive throughout the atoll and lagoon both to the east and west. No significant secondary fall-out was encountered at Bikini as a result of this detonation.

Lagoon water was heavily contaminated with radioactive sediment. Readings of 1 r/hr were obtained at 100 feet altitude in the vicinity of zero point [redacted]+1 day. Floating objects revealed readings of 1 to 3 r/hr on shot day. Small boats and barges in Bikini - Enyu anchorage were contaminated to a moderate degree (1 - 6 r/hr). Lagoon flushing through the southwest passage materially increased radiation levels in Eniirikku - Bokororyuru areas. Results are shown in Table 7-1.

[redacted]

[redacted]

TABLE 7-1
[redacted] RADIATION SUMMARY
r/hr

Island	Extrapolated H + 4 hrs	1 day	5 days**	Background
Enyu	18.	2.0	.44	.02
Bikini	225.	25.	2.0	.32
Aomoen	50.	6.	.80	1.0
Romurikku	65.	7.5	1.2	1.0
Uorikku	95.	12.	2.0	.25
Yurochi	95.	12.	4.0	1.0
Namu	10.	- -	1.0	.80
Bokobyaadaa	- -	- -	.95	3.0
Ourukaen	3.5(?)	.50*	.12*	.01
Arriikan	1.3	.60*	.10*	.08
Eniirikku	.18	.01	.01 - 1.0	.03
Airukiiji	.505	.01	.01	.01
Crater	- -	1.0***	- -	- -
Lagoon	- -	- -	80(West)	- -

* Radiation shine from water in southwest passage.

** Final aerial survey.

*** Reading at 100 feet.

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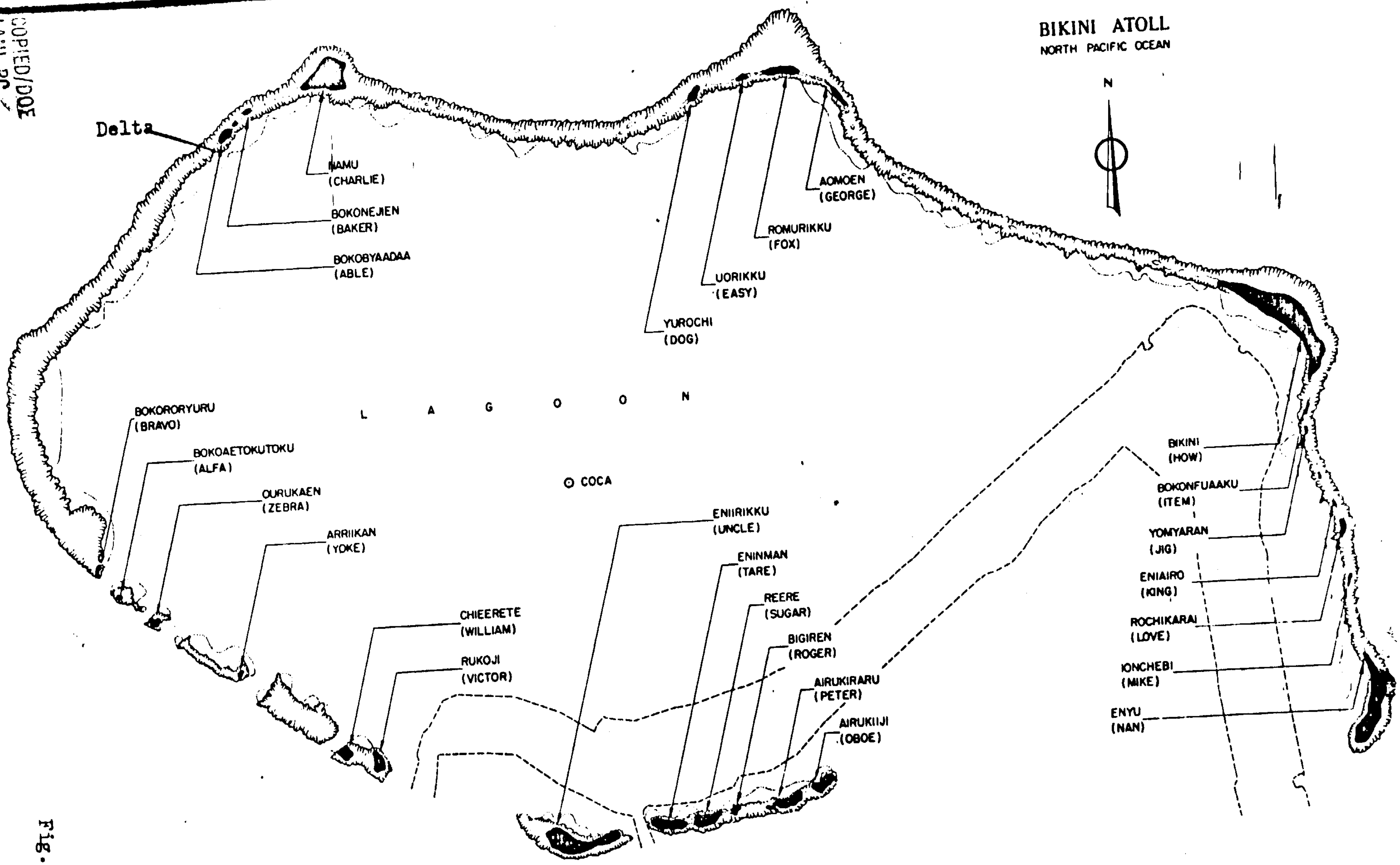
WEATHER (BIKINI ATOLL) AT 0610, 5 MAY 1954

Surface Pressure 1010.8 mb
Surface Temperature 80.8° F
Surface Humidity 84%

Altitude (ft)	Wind Direction (degrees)	Velocity (knots)	Pressure	Temp. (°C)	Dew Pt. (°C)	Relative Humidity
Surface	080	24	1010.8	27.1	23.9	83
1000	070	23	980	24.5	22.7	90
1500	075	24	959	22.2	20.2	88
2000	080	25	945	21.9	20.0	91
3000	080	24	910	20.1	18.7	92
4000	080	23	879	18.6	17.4	92
5000	070	20	850	17.0	16.0	93
6000	070	20	820	15.7	13.8	90
7000	070	18	790	14.2	11.0	81
8000	070	11	763	12.7	6.2	70
9000	040	06	737	10.8	1.0	51
10000	020	05	710	9.4	3.0	65
12000	010	05	663	6.0	-0.8	63
14000	340	05	616	3.3	-17.3	20
16000	320	13	572	0.4		
18000	280	09	528	-3.0	-18.0	30
20000	290	14	491	-6.6	-17.8	43
25000	230	23	398	-19.6	-24.0	61
30000	220	34	322	-29.0		
35000			259	-39.0		
40000			207	-46.0		
45000	280	56				
50000	250	44				
52000	200	46				

[redacted]



[redacted]

Fig. A-1